This additional evidence of technical feasibility was not properly associated with the SCI preference request. In fact, the test results were submitted by Dr. Roy in File No. S-1193-EX-93 in connection with an experimental STA granted to ArrayComm. However, SCI should not be penalized for this inadvertent oversight. In reality, Dr. Roy's duties on behalf of SCI and ArrayComm, SCI's parent company, have a common goal: development and implementation of SDMA technology. Dr. Roy viewed the interests of the two commonly-owned companies as identical, and assumed that the Commission would take cognizance of the supplemental technical information relating to SDMA technology.

Throughout the past five years (and before), Dr. Roy has been focusing on technology development and on obtaining the necessary support to continue his pioneering work in SDMA technology. If, in fact, the Commission's intention is to reward innovators, it cannot find better examples than Martin Cooper and Dr. Roy who have devoted their lives to developing dramatic new technologies with substantial public interest benefits.

Footnote continued from previous page.

> data was a material issue, and the misfiled pleading disputed the applicant's data. According to the Commission, the failure to consider the misfiled pleading could not be considered "harmless error." Similarly, here, the failure to consider the experimental test results was highly prejudicial to SCI.

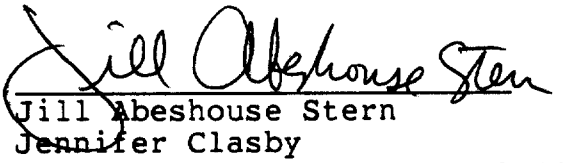
The record should be re-opened, if and as necessary, for purposes of evaluating SCI's preference request in light of this "new" information. This additional evidence of SDMA's technical feasibility, in addition to other compelling information on file, requires reversal of the Commission's decision, and grant of a well-deserved preference to SCI and its principals for their pioneering work in developing SDMA.

V.
CONCLUSION

For the reasons set forth herein, the Commission should reverse its previous decision, and grant a pioneer's preference to SCI for its innovative work in developing SDMA technology.

Respectfully submitted,

SPATIAL COMMUNICATIONS, INC.

By: 

Jill Abeshouse Stern
Jennifer Clasby
SHAW, PITTMAN, POTTS & TROWBRIDGE
2300 N Street, N.W.
Washington, DC 20037
202-663-8380

Its Attorneys

March 30, 1994

DECLARATION

I, Dr. Richard Roy, do hereby declare as follows:

1. I have a Ph.D. in Electrical Engineering from Stanford University.
2. I am presently Chief Scientist of Spatial Communications, Inc. and President and Chief Technical Officer of ArrayComm, Inc.
3. I am the lead developer of a proprietary advanced spectrum access management technology known as Spatial Division Multiple Access ("SDMA").
4. I have either prepared or reviewed the technical information contained in the foregoing petition for reconsideration of the application of Spatial Communications, Inc. for a Pioneer's Preference in the Licensing Process for Personal Communications Services, and all the attachments thereto.
5. The technical facts contained in the above-mentioned documents are accurate to the best of my knowledge and belief.

Under the penalties of perjury, the foregoing is true and correct.

30 March 1994
Date

Richard Roy
Dr. Richard H. Roy

Exhibit A

EXHIBIT A

AFFIDAVIT

I, Dennis M. Rucker do hereby declare as follows:

1. This testimony is being provided solely for the purpose of being used in conjunction with ArrayComm's pending FCC filing, and in no other instance.

2. I am currently Director of Engineering for the United States Cellular Corporation, and have currently held my position for nine (9) months.

3. I am a duly qualified engineer, whose qualifications are a matter of record before the Federal Communications Commission. I hold the following degrees:

   BSEE, Purdue, 1972

   I have more than 22 years of experience in the design and development of telecommunications systems. Previous positions include the following:

   Senior Director, Science & Technology, Ameritech Cellular

4. In my current position, I am responsible for supervising the design and installation of cellular telecommunications networks on a nationwide basis.

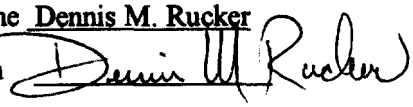
5. In my capacity as Director of Engineering, I have fully reviewed the theoretical and practical basics of ArrayComm's SDMA technology and witnessed a video taped demonstration thereof, and will be participating in a field demonstration.

6. On the basis of my review of the relevant literature and first-hand observations, it is my expert opinion the ArrayComm's SDMA is technically feasible and represents a truly innovative approach to increasing spectral efficiency. Deployment of SDMA technology will substantially reduce the amount of radiated (RF) power (over current technologies) required, per link, to establish reliable communication through directional transmission from and directional transmission by base stations, and will allow multiple wireless links to share the same spectrum in the same cell. The benefits include lower power handsets and base station RF transmissions, and a substantial increase in spectral efficiency. In the context of PCS, deployment of SDMA technology will facilitate more efficient use of available spectrum for all service providers, in addition, to alleviating some of the OFS coexistence issues by substantially reducing contemplated exclusion zones.

Under penalty of perjury, the following is true and correct to the best of my knowledge.

US Cellular Corporation

Name Dennis M. Rucker

Sign 

Title Director of Engineering

Date March 28, 1994

AFFIDAVIT

I, George D. Geotsalitis do hereby declare as follows:

1. This testimony is being provided solely for the purpose of being used in conjunction with ArrayComm's pending FCC filing, and in no other instance.

2. I am currently Manager of PCS Standards for the United States Cellular Corporation, and have currently held my position for four (4) months.

3. I have more than 22 years of experience in the design and development of telecommunications systems. Previous positions include the following:

   Assistant Director, Standards, Ameritech Cellular
   Manager, Instruction/Development, Bellcore
   Manager, Transmission Engineering, Illinois Bell
   Manager, Technical Planning, Illinois Bell

4. In my current position, I am responsible for participation in the development of standards for PCS.

5. In my capacity as Manager PCS Standards, I have fully reviewed the theoretical and practical basics of ArrayComm's SDMA technology and witnessed a field demonstration thereof.

6. On the basis of my review of the relevant literature and first-hand observations, it is my expert opinion the ArrayComm's SDMA is technically feasible and represents a truly innovative approach to increasing spectral efficiency. Deployment of SDMA technology will substantially reduce the amount of radiated (RF) power (over current technologies) required, per link, to establish reliable communication through directional transmission from and directional transmission by base stations, and will allow multiple wireless links to share the same spectrum in the same cell. The benefits include lower power handsets and base station RF transmissions, and a substantial increase in spectral efficiency. In the context of PCS, deployment of SDMA technology will facilitate more efficient use of available spectrum for all service providers, in addition, to alleviating some of the OFS coexistence issues by substantially reducing contemplated exclusion zones.

Under penalty of perjury, the following is true and correct to the best of my knowledge.

US Cellular Corporation

Name George D. Geotsalitis
Sign George D. Geotsalitis
Title Manager, PCS Standards
Date March 28, 1994

AFFIDAVIT

I, Stuart Jeffery do hereby declare as follows:

1. I am currently Vice President of Kycom, and have held my current position for over one year.

2. I am a duly qualified engineer, whose qualifications are a matter of record before the Federal Communications Commission. I hold the following degrees:

   BS Physics, Ohio State University
   Graduate Studies in Electrical Engineering, University of Colorodo
   Exective MBA, Northeastern Universtiy

   I hold a First Class FCC Radiotelephone License.

   I have more than 25 years experience in the design and development of telecommunications systems. Previous positions include the following:

   Director of Network Systems, GTE Corporation, Waltham, MA.
   Director of EW Systems, GTE Corporation, Mt View, CA.
   Manager of ESM Systems, ERA, a division of E-Systems, Reston, VA.
   Research Physicist, NBS, Boulder, CO.
   Assistant Chief Engineer, Ohio State University Telecommunications Center, Columbus, OH.

3. In my current position, I am responsible for supervising the design and development of Kycom's PCS telecommunications network.

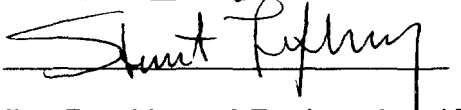
4. In my capacity as Vice President of Kycom, I have fully reviewed the theoretical and practical bases of ArrayComm's SDMA technology and witnessed field demonstrations thereof.

5. On the basis of my review of the relevant literature and first-hand observations, it is my expert opinion that ArrayComm's SDMA technology is technically feasible and represents a truly innovative approach to increasing spectral efficiency. Deployment of SDMA technology will substantially reduce the amount of radiated (RF) power (over current technologies) required per link to establish reliable communication through directional transmission from and directional reception by base stations, and will allow multiple wireless links to share the same spectrum in the same cell. The benefits include lower power handset and base station RF transmissions, and a substantial increase in spectral efficiency. In the context of PCS, deployment of SDMA technology will facilitate more efficient use of available spectrum for all service providers, in addition to alleviating some of the OFS coexistence issues by substantially reducing contemplated exclusion zones.

Under penalty of perjury, the foregoing is true and correct to the best of my knowledge.

Kycom

Name Stuart S. Jeffery

Sign 

Title Vice President of Engineering, Kycom

Date March 29, 1994

AFFIDAVIT

I, Guy Jouannelle do hereby declare as follows:

1. I am currently Senior Engineer of LCC LLC and have held my current position for 1 year.

2. I have more than 11 years experience in the design and development of telecommunications systems. Previous positions include the following:

   - Research Engineer of ONERA (France), responsible for antenna arrays conception, design and experimentation, and propagation modeling,
   - Project Manager at Alcatel Radiotelephone (France), for radio engineering tool development,
   - Director of Technical Development at France Telecom, responsible for all technical aspects of a GSM National Network Radio Engineering and Deployment.

3. In my current position, I am responsible for supervising PCS technologies trends analysis and associated radio engineering tools development.

4. In my capacity as Senior Engineer of LCC, I have reviewed theoretical and practical bases of ArrayComm's SDMA technology and witnessed field demonstrations thereof.

5. On the basis of my review of the relevant literature and observations, it is my expert opinion that ArrayComm's SDMA technology is technically feasible and represents a truly innovative approach to increasing spectral efficiency. Deployment of SDMA technology will substantially reduce the amount of radiated (RF) power (over current technologies and for the same cell size) required per link to establish reliable communications through directional transmission from and directional reception by base stations, and will allow multiple wireless links to share the same spectrum in the same cell. The benefits include lower power handset and base station RF transmissions, and a substantial increase in spectral efficiency. In the context of PCS, deployment of SDMA technology will facilitate more efficient use of available spectrum for all service providers.

Under penalty of perjury, the foregoing is true and correct to the best of my knowledge.

LCC LLC

Name : Guy Jouannelle

Sign 

Title : Senior Engineer
Date : 30 March, 1994

Exhibit B

EXHIBIT B

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Request of Spatial Communications, Inc. for a Pioneer's Preference In the Licensing Process for Personal Communications Services	)	PP No. 73
	)	
In the Matter of	)	
	)	
Amendment of the Commission's Rules To Establish New Personal Communications Services	)	Gen. Docket No. 90-314

To: The Commission

REQUEST FOR PIONEER'S PREFERENCE OF SPATIAL COMMUNICATIONS, INC.

J. Daniel Bariault
President

Spatial Communications, Inc.
1001 Fourth Avenue Plaza
Suite 3200
Seattle, Washington 98154

Jerome K. Blask
Coleen M. Egan

Gurman, Kurtis, Blask & Freedman Chartered
1400 16th Street, N.W.
Suite 500
Washington, D.C. 20036

Its Attorneys

Walter H. Sonnenfeldt,
Policy Consultant

May 4, 1992

SUMMARY

Spatial Communications, Incorporated ("SCI"), pursuant to Section 1.402 of the Commission's Rules, hereby requests a Pioneer's Preference in the licensing process for Personal Communications Services ("PCS") in General Docket No. 90-314. This request is premised on SCI's plan to provide PCS using a dramatic new technology, Spatial-Division Multiple Access ("SDMA"), developed and patented by principals of SCI.

SCI's SDMA technology makes possible for the first time dynamic real-time exploitation of the spatial dimension in the mobile personal communications system spectral utilization scheme. SDMA technology is fully compatible with all current Frequency-Division Multiple Access ("FDMA"), Time-Division Multiple Access ("TDMA"), and Code-Division Multiple Access ("CDMA") frequency management technologies.

SCI's PCS SDMA technology will yield increases in PCS system spectral efficiency as high as a factor of ten, in addition to efficiencies afforded by use of FDMA, TDMA, and CDMA. The ability of SDMA-equipped PCS systems to dynamically control the direction and power level (effective distance) of signal transmissions will also result in significant improvements in PCS signal quality. Additionally, initiating PCS with SDMA will reduce the costs of implementing PCS, and maximize dynamic spectrum sharing between PCS systems and existing users in other services. Incorporating the SDMA spectral management technique in the PCS regulatory framework will also expand the Commission's PCS licensing options by increasing the effective capacity of PCS spectrum allocations.

In sum, integrating SDMA with PCS will:

- Significantly increase the effective channel capacity of PCS base stations;
- Significantly increase the quality of communications links;
- Significantly reduce the required amount of transmitted power from both base stations and mobile units;
- Lower the overall system cost by reducing the number of base stations required to handle a given system load;
- Significantly increase flexibility in system architecture;
- Significantly reduce or completely eliminate harmful interference to and from existing primary services resulting from co-primary PCS system operations; and
- Facilitate extremely precise position determination capabilities in a PCS system with no significant increase in deployment cost.

* * * * *

A rigorous series of tests confirming the precise accuracy and flexible operation of SCI's prototype SDMA system, documented in Appendix A hereto, conclusively demonstrate the feasibility of PCS SDMA technology. In addition, cost/benefit analyses presented by SCI demonstrate the economic feasibility of implementing PCS SDMA and attendant PCS system profitability increases that will result.

The pioneering accomplishments of SCI, and its principals, in the development of PCS SDMA technology, and the revolutionary enhancements in spectral efficiency, service quality, system design flexibility, and co-primary sharing capability resulting therefrom clearly meet the Commission's rigorous qualification standards for

grant of a Pioneer's Preference. Accordingly, the Commission should award SCI a Pioneer's Preference in connection with the PCS rulemaking proceedings in General Docket No. 90-314.

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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Request of Spatial Communications, Inc. for a Pioneer's Preference In the Licensing Process for Personal Communications Services	)	PP No. _____
In the Matter of	)	
	)	
Amendment of the Commission's Rules To Establish New Personal Communications Services	)	Gen. Docket No. 90-314

To: The Commission

REQUEST FOR PIONEER'S PREFERENCE

Spatial Communications, Incorporated ("SCI"), pursuant to Section 1.402 of the Commission's Rules, hereby requests a Pioneer's Preference in the licensing process for Personal Communications Services ("PCS") in General Docket No. 90-314.[1] This request is premised on SCI's plan to provide PCS using a dramatic new technology, Spatial-Division Multiple Access ("SDMA"), developed and patented by principals of SCI.

---

[1] 47 CFR §1.402. See also, Establishment of Procedures to Provide a Preference to Applicants Proposing an Allocation for New Services, 6 FCC Rcd 3488 (1991) ("Pioneer's Preference Order"), recon., FCC 92-57, released February 26, 1992 ("Pioneer's Preference Reconsideration Order"). Submission of the instant request complies with the Commission's PCS pioneer's preference request filing deadline in Gen. Docket No. 90-314. See FCC Public Notice No. 22536, released April 3, 1992.

SCI's SDMA technology makes possible for the first time dynamic real-time exploitation of the spatial dimension in the mobile personal communications system spectral utilization scheme. As demonstrated fully below and in Appendix A hereto, application of SCI's PCS SDMA technology will yield increases in the spectral efficiency of PCS systems as high as a factor of ten. The ability of SDMA-equipped PCS systems to dynamically control the direction and power level (effective distance) of signal transmissions will also result in significant improvements in PCS signal quality. Additionally, initiating PCS with SDMA will reduce the costs of implementing PCS, and maximize dynamic spectrum sharing between PCS systems and existing users in other services. SDMA technology is fully compatible with all current Frequency-Division Multiple Access ("FDMA"), Time-Division Multiple Access ("TDMA"), and Code-Division Multiple Access ("CDMA") frequency management technologies, and can be readily employed in PCS systems utilizing these techniques. Incorporating the SDMA spectral management technique in the Commission's PCS regulatory framework will expand the range of PCS licensing options by increasing the effective capacity of PCS spectrum allocations. SDMA technology will profoundly improve the design and operation of PCS systems and should be an integral component of the Commission's PCS regulatory framework.

The pioneering accomplishments of SCI, and its principals, in the development of PCS SDMA technology, and the revolutionary enhancements in spectral efficiency, service quality, system design

flexibility, and co-primary sharing capability resulting therefrom, clearly meet the Commission's rigorous qualification standards for grant of a Pioneer's Preference. Accordingly, the Commission should award SCI a Pioneer's Preference in connection with the PCS rulemaking proceedings in General Docket No. 90-314.

I. BACKGROUND

SCI is a Delaware corporation, formed to develop and commercialize a full-range of PCS technologies. A central focus of SCI's PCS commercialization efforts is application of proprietary SDMA spectral management technology to operating PCS systems. One World Telecommunications, Inc. ("OWT"), a major shareholder of Spatial Communications JV, Inc., SCI's parent company, is a leader in the development and marketplace implementation of state-of-the-art PCS microcellular technologies. Key principals of OWT, who have been involved in cellular communications since 1983, and in PCS technology development since 1990, also serve as officers and directors of SCI. Dr. Richard Roy, the lead inventor of SDMA technology, serves both as a director and as Chief Scientist of SCI.[1] Other members of the SDMA development team serve as SCI's Principal Engineer and Science Advisor. SCI's corporate resume is attached hereto as Appendix B.

---

[1] Dr. Roy is also a Research Associate at Stanford University in Palo Alto, California.

II. DESCRIPTION OF PCS SDMA TECHNOLOGY

SDMA is a pioneering frequency access technology, developed over a fifteen-year period and patented by principals of SCI. Essentially, SDMA involves dynamic, real-time utilization of the spatial dimension in the frequency assignment process of wireless mobile communications systems. SDMA is particularly well-suited to application in the PCS operating environment.

Simple, low-cost multiple antenna arrays, advanced high-speed special purpose digital real-time signal processing hardware, and customized SDMA network control software comprise the essential components of an SDMA system. Base stations in a PCS system employing SDMA can manage multiple, simultaneous co-channel transactions within their individual service area (i.e., cell or cell sector). SDMA technology exploits the spatial dimension in the frequency assignment process by dividing the coverage area of a PCS base station antenna into angular transmission sectors ("spatial channels"). An SDMA signal processor can assign spatial channels on a real-time basis for use in a PCS system. Dynamic real-time spatial management of spectrum utilization either in an entire PCS system or in selected cells can be achieved by interconnecting base stations equipped with SDMA antenna arrays to a central SDMA network control facility.

Incorporating SDMA technology in a PCS system architecture will dramatically increase spectral efficiency and signal quality, while allowing PCS systems to operate on a co-primary basis with

other existing radio services (e.g., point-to-point microwave) with virtually no threat of causing or suffering harmful interference. Specifically, integrating SDMA with PCS will:

- Significantly increase the effective channel capacity of PCS base stations;
- Significantly increase the quality of communications links;
- Significantly reduce the required amount of transmitted power from both base stations and mobile units;
- Lower the overall system cost by reducing the number of base stations required to handle a given system load;
- Significantly increase flexibility in system architecture;
- Significantly reduce or completely eliminate harmful interference to and from existing primary services resulting from co-primary PCS system operations; and
- Facilitate extremely precise position determination capabilities in a PCS system with no significant increase in deployment cost.

* * * * *

SDMA technology is fully compatible with all analog and digital signal modulation schemes proposed for PCS systems, including FDMA, TDMA, and CDMA. Spectral efficiency and signal-to-noise ratio ("SNR") gains that can be realized with SDMA technology vary with respect to the underlying modulation scheme and the number of antennas in an SDMA antenna array at a cell. SDMA testing to date indicates that spectral capacity increases of a factor as high as 10 relative to omni-directional PCS platforms are technically and economically feasible. The increased spectral

capacity and signal quality that SDMA provides can be traded off in PCS system design for reductions in the number of base stations, to enhance signal strength, or for increases mobile unit talk time. A detailed technical description of individual SDMA system components and possible SDMA PCS network configurations is provided in Section 3 of Appendix A.

As discussed more fully in the following Section, SCI plans to conduct an aggressive program of PCS SDMA field trials over the next several months. SCI anticipates the initiation of full-scale commercial production of PCS SDMA equipment within two years.

III. DESCRIPTION OF THE SCI PCS RESEARCH AND DEVELOPMENT PROGRAM

A. General PCS Research And Development Activities

OWT has been researching the viability of PCS in the United States since 1990. Upon grant of an FCC experimental authorization in December 1991, OWT proceeded with its plans to engage in an aggressive program of PCS research, including field tests and demonstrations in Seattle, Washington, and in Los Angeles and Long Beach, California.[y] OWT's experimental plan calls for evaluating possible deployment scenarios for CT-2, CT-2 Plus, and CT-3 PCS platforms operating in the range of 901-960 MHz and in the range 1800-2200 MHz frequency bands. OWT is addressing pivotal PCS

[y] File No. 2029-EX-PL-91; Call Sign KK2XAL.

issues such as techniques for interservice sharing, user location management and traffic engineering. Additionally, OWT is studying overall PCS administration, and developing proprietary systems for customer billing, operator and maintenance services, intersystem administration, and system monitoring. OWT is licensed to conduct field experiments in Seattle, Washington, and in Los Angeles and Long Beach, California. Concurrent with the submission of the instant Request For Pioneer's Preference, OWT is filing an application to assign its PCS experimental license to SCI. Timely Commission approval of the assignment application will serve the public interest by precluding unnecessary delays in SCI's initiation of PCS SDMA field trials that could result if SCI were to apply at this time for an entirely new experimental authorization. SCI will be able to take advantage of important third party relationships, formed by OWT to facilitate field experimentation in three key PCS operating environments defined as a result of market research performed by OWT (i.e., residential, public access, and commercial/business).

B. SCI's Plan For PCS SDMA Implementation

SCI is in the process of executing a two-year plan for commercial roll-out of PCS SDMA technology, beginning with preliminary field tests to be conducted within the next few months, pursuant to Commission approval of OWT's application to assign its existing experimental license to SCI. SCI's plan culminates in

mass production and installation of SDMA base stations in fully operational PCS systems by early 1994.

Through July of 1992, SCI will perform additional SDMA testing in a controlled RF environment (anechoic chamber), and in SCI's robust computer simulator. These tests are being conducted to reaffirm and expand data obtained in previous analyses on the performance envelope of the SDMA receive system and its sensitivity to hardware imperfections under controlled conditions. During this period, testing will be expanded to include field tests of a full-duplex transmit/receive SDMA system.

Also during the first four months, propagation studies in the 901-960 MHz and 1850 to 1990 MHz bands will be performed to ascertain relevant RF properties of the environments in which PCS SDMA systems will be operating. CT-2 platforms will be deployed at Stevedoring Services of America, located at Pier 18, Seattle, Washington, and at the Sheraton Seattle Hotel & Towers, and technical and market surveys will be undertaken.

A robust full-scale prototype PCS SDMA system will be designed, constructed, and tested between August 1992 and April 1993. The SDMA system will be integrated into a CT-2 Plus base station and once tested, three such base stations will be constructed, tested, and integrated into a small prototype PCS SDMA network.

Deployment of the CT-2 platforms at Stevedoring Services of America and the Sheraton Seattle Hotel & Towers will be expanded from September 1992 to January 1993. A CT-2 platform will be